

IN THE CLAIMS:

1.-43. (Cancelled)

44. (Previously amended) A method of manufacturing articles to be included in cans, comprising:

intermittently feeding a metal strip having an upper surface and a lower surface into an article forming unit; and

providing at least one of the upper surface and the lower surface of the strip with laser engravings from a laser unit when the strip is in an immobilized condition and before the strip is fed into the article forming unit where the articles are formed, said laser engravings forming marks on at least one of the upper surface and the lower surface of the strip.

45. (Previously added) A method as claimed in claim 44, wherein the laser engravings have a depth of about 1-5 μm .

46. (Previously added) A method as set forth in claim 44, wherein the laser engravings are generated using a beam of laser radiation in the near IR wavelength range.

47. (Previously added) A method as set forth in claim 46, wherein the laser beam is in the form of pulsed laser radiation.

48. (Previously added) A method as set forth in claim 46, wherein the laser beam is generated using an Nd:YAG laser.

49. (Previously added) A method as set forth in claim 48, wherein the Nd:YAG laser is a diode laser pumped Nd:YAG laser.

50. (Previously added) A method as set forth in claim 46, further comprising selectively transmitting portions of the laser beam through a mode selection element in order to obtain suitable laser mode characteristics.

51. (Previously added) A method as set forth in claim 50, further comprising arranging the mode selection element within a laser cavity adapted to generate said laser beam.

52. (Previously added) A method as set forth in one of claims 50 and 51, wherein the laser mode characteristics are TEM₀₀ characteristics.

53. (Previously added) A method as set forth in claim 46, further comprising:
focusing the laser beam on a strip surface selected from the upper surface and the lower surface; and
increasing a diameter of the laser beam before the laser beam is focused.

54. (Previously added) A method as set forth in claim 53, wherein the laser beam is focused on the selected strip surface using a flat-field lens having an effective focal length of approximately 120-180 mm.

55. (Previously added) A method as set forth in claim 53, further comprising effecting controlled deflection of the laser beam in two mutually perpendicular directions for providing the marks on the articles, the laser beam being deflected before being focused.

56. (Previously added) A method as set forth in claim 44, further comprising forming the articles integrated using the strip with the article forming unit.

57. (Previously added) A method as set forth in claim 44, further comprising guiding the strip past the laser unit.

58. (Previously added) A method as set forth in claim 44, further comprising guiding the strip using guiding elements, while passing the laser unit, through a longitudinal channel, the guiding elements bearing on opposite longitudinal edges of the strip, wherein at least one of the guiding elements is displaceable and is biased towards the strip.

59. (Previously added) A method as set forth in claim 58, wherein each of the guiding elements comprises a freely rotatable body having a peripheral surface that bears on a longitudinal edge of the strip.

JENDICK - Appln. No. 09/412,362

60. (Previously added) A method as set forth in claim 58, further comprising:
arranging at least one guiding cover between the guiding elements with a small
clearance from the upper surface or the lower surface of the strip; and
focusing the laser beam onto the upper surface or the lower surface through an
opening in the at least one guiding cover.

61. (Previously added) A method as set forth in claim 44, wherein the articles are
opening tabs to be attached to ends of the cans.

62. (Previously added) A method as set forth in claim 61, wherein peripheral edge
portions of each tab are bent inwardly and an opening is cut in the tab, and wherein the laser
engravings are provided on a surface of the tab between the opening and the bent edge
portions of the tab.

63. (Previously amended) An apparatus for manufacturing articles to be included
in cans, comprising:

a supply of a metal strip having an upper surface and a lower surface;
an article forming unit;
a strip feeder between the supply and the article forming unit, the strip feeder
intermittently moving the strip into the article forming unit such that the strip is in an
immobilized condition between periods of intermittent movement;

a laser unit arranged between the supply of metal strip and the article forming unit, the
laser unit providing laser engravings on at least one of the upper surface and the lower
surface of the strip, the laser engravings forming marks on at least one of the upper surface
and the lower surface of the strip to be formed into the articles by the article forming unit;
and

a control unit in communication with the laser unit, the laser unit being controlled so
that the laser engravings are provided on at least one of the upper surface and the lower
surface of the strip when the strip is in the immobilized condition between the periods of
intermittent movement.

64. (Previously added) An apparatus as claimed in claim 63, wherein the laser
engravings have a depth of about 1-5 μm .

65. (Previously added) An apparatus as set forth in claim 63, wherein the laser unit includes a beam generator that generates a beam of laser radiation in the near IR wavelength range.

66. (Previously added) An apparatus as set forth in claim 65, wherein the laser beam comprises a beam of pulsed laser radiation.

67. (Previously added) An apparatus as set forth in claim 65, wherein the beam generator comprises one of an Nd:YAG laser and a diode laser pumped Nd:YAG laser.

68. (Previously added) An apparatus as set forth in claim 65, wherein the beam generator includes a laser cavity, and a mode selection element defining an aperture of variable diameter, the mode selection element being arranged to selectively transmit a portion of the laser beam for obtaining suitable laser mode characteristics.

69. (Previously added) An apparatus as set forth in claim 68, wherein the mode selection element is arranged in the laser cavity.

70. (Previously added) An apparatus as set forth in one of claims 68 and 69, wherein the laser mode characteristics are TEM₀₀ laser mode characteristics.

71. (Previously added) An apparatus as set forth in claim 65, wherein the laser unit further comprises a beam expander that increases a diameter of the laser beam emitted from the beam generator, and a beam focuser that focuses the laser beam onto one of the upper surface and the lower surface of the strip, the beam expander being arranged upstream of the beam focuser.

72. (Previously added) An apparatus as set forth in claim 71, wherein the beam focuser comprises a flat-field lens having an effective focal length of approximately 120-180 mm.

73. (Previously added) An apparatus as set forth in claim 71, wherein the laser unit further comprises a beam deflector that effects a controlled deflection of the laser beam

JENDICK - Appln. No. 09/412,362

in two mutually perpendicular directions, the beam deflector being arranged intermediate the beam expander and the beam focuser.

74. (Previously added) An apparatus as set forth in claim 63, wherein the article forming unit is arranged to form the articles integrated with the strip.

75. (Previously added) An apparatus as set forth in claim 63, wherein the laser unit is arranged adjacent to the article forming unit but does not impart vibrations to or otherwise disrupt operation of the article forming unit.

76. (Previously added) An apparatus as set forth in claim 63, further comprising a guide that guides said strip past said laser unit.

77. (Previously added) An apparatus as set forth in claim 76, wherein said guide includes a longitudinal channel that receives said strip, the channel being at least partly defined by guiding elements that are arranged for abutment against opposite longitudinal edges of the strip, wherein at least one of the guiding elements is displaceable and biased towards the channel.

78. (Previously added) An apparatus as set forth in claim 77, wherein each of the guiding elements comprises a freely rotatable body having a peripheral surface for abutment against a longitudinal edge of the strip.

79. (Previously added) An apparatus as set forth in claim 77, wherein the channel is further defined by at least one guiding cover that is arranged between the guiding elements with a small clearance from one of said upper and lower surfaces of the strip, the guiding cover defining an opening allowing the laser unit to provide the laser engravings on at least one of the upper surface and the lower surface.

80. (Previously added) An apparatus as set forth in claim 63, wherein the laser unit is disconnectible for allowing article manufacture without marking of the strip.

81. (Previously amended) An apparatus as set forth in claim 63, wherein said articles are opening tabs to be attached to ends of the cans.

JENDICK - Appln. No. 09/412,362

82. (Previously added) An apparatus as set forth in claim 81, wherein each of the tabs includes inwardly bent peripheral edge portions that are formed with the article forming unit, and the article forming unit includes a cutter that cuts an opening in each of the tabs, the laser unit being adjustable in such way that the marks are provided on a surface of each of the tabs between the opening and the bent edge portions of each of the tabs.

83-89. (Cancelled)

90. (Previously added) An apparatus for manufacturing articles to be included in cans, comprising:

an article forming unit;

a strip feeder between the supply and the article forming unit, the strip feeder moving the strip into the article forming unit in periods of rapid movement;

a laser unit arranged between the supply of metal strip and the article forming unit, the laser unit providing laser engravings on at least one of the upper surface and the lower surface of the strip, the laser engravings forming marks on at least one of the upper surface and the lower surface of the strip to be formed into the articles by the article forming unit; and

a control unit in communication with the laser unit, the laser unit being controlled so that the laser engravings are provided on at least one of the upper surface and the lower surface of the strip when the strip is between the periods of rapid movement.

91. (Previously added) A method of manufacturing articles to be included in cans, comprising:

feeding a metal strip having an upper surface and a lower surface into an article forming unit, said strip being fed in periods of rapid movement; and

providing at least one of the upper surface and the lower surface of the strip with laser engravings from a laser unit when the strip is in between the periods of rapid movement and before the strip is fed into the article forming unit where the articles are formed, said laser engravings forming marks on at least one of the upper surface and the lower surface of the strip.

92. (Cancelled)

JENDICK - Appln. No. 09/412,362

93. (Previously added) A method of manufacturing opening tabs to be attached to ends of cans, comprising:

intermittently moving a metal strip having an upper surface and a lower surface along a predetermined path into an opening tab forming unit where the opening tabs are formed;

providing a laser unit along the path at a position that precedes the opening tab forming unit; and

forming laser engraved marks with the laser unit on at least a selected surface of the upper surface and the lower surface of the strip when the strip is in an immobilized condition, whereby the laser unit is controlled during immobilization of the strip such that the laser engraved marks form a distinct code on the selected surface.

94. (Previously added) A method as set forth in claim 93, wherein the distinct code is at least one of a code that indicates a site of production, an hour code indicating when the tab was produced, a minute code indicating when the tab was produced, and a code that indicates that a person who opens the can using the tab is a winner.

95. (Previously added) An apparatus for manufacturing opening tabs to be attached to ends of cans, comprising:

a supply of a metal strip having an upper surface and a lower surface;

an opening tab forming unit provided along a predetermined path following the supply and structured to form opening tabs;

a strip feeder structured to intermittently move the strip along the path into the opening tab forming unit;

a laser unit provided along the path at a position that precedes the opening tab forming unit, the laser unit providing laser engraved marks on at least one of the upper surface and the lower surface of the strip; and

a control unit in communication with the laser unit, the control unit controlling the laser unit so that the laser engraved marks are provided on at least a selected surface of the upper surface and the lower surface of the strip when the strip is in the immobilized condition, whereby the laser unit is controlled during immobilization of the strip such that the laser engraved marks form a distinct code on the selected surface.

JENDICK - Appln. No. 09/412,362

96. (Previously added) An apparatus as set forth in claim 95, wherein the distinct code is at least one of a code that indicates a site of production, an hour code indicating when the tab was produced, a minute code indicating when the tab was produced, and a code that indicates that a person who opens the can using the tab is a winner.

97. (Cancelled)

98. (Previously added) An apparatus as claimed in claim 63, wherein the metal strip has a thickness defined between the upper surface and the lower surface, and the laser engravings extend into a metal portion of the metal strip to a depth that is within the thickness of the metal strip.

99. (Previously added) A can with a laser engraved tab formed by the method according to claim 44.

100. (Previously added) A method as claimed in claim 44, further comprising extending the laser engravings a finite depth into a metal portion of the metal strip to form marks in at least one of the upper surface and the lower surface of the metal strip.

101. (Previously added) A method as claimed in claim 44, wherein the strip is in the immobilized condition for less than about 60 milliseconds for forming at least four characters.

102. (Previously added) An apparatus as claimed in claim 63, wherein the strip is in the immobilized condition for less than about 60 milliseconds for forming at least four characters.

103. (Previously added) A method a method of manufacturing articles to be included in cans, comprising:
intermittently feeding a metal strip having a metal surface into an article forming unit;
and
providing the metal surface of the strip with laser engravings from a laser unit when the strip is in immobilized condition and before the strip is fed into the article forming unit

JENDICK - Appln. No. 09/412,362

where the articles are formed, the laser engravings forming marks into the metal surface of the strip.

104. (Previously added) A method as claimed in claim 103, further comprising:
providing a coating on the metal strip; and
extending the laser engravings through the coating and into the metal surface of the strip.

105. (New) A method as claimed in claim 44, wherein the upper surface of the metal strip includes a coating and the coating is laser engraved.

106. (New) A method as claimed in claim 105, wherein the laser engravings extend through the coating and into the metal strip.

107. (New) A method as claimed in claim 105, wherein the articles are can ends and the laser engravings are provided in the can ends for traceability.

108. (New) A method as claimed in claim 44, wherein the articles are tabs to be attached to can ends and the laser engravings include markings into the metal strip to indicate a person who uses a selected one of the tabs is a winner.

109. (New) An apparatus as claimed in claim 63, wherein the upper surface of the metal strip includes a coating and the coating is laser engraved.

110. (New) An apparatus as claimed in claim 109, wherein the laser engravings extend through the coating and into the metal strip.

111. (New) An apparatus as claimed in claim 109, wherein the articles are can ends and the laser engravings are provided in the can ends for traceability.

112. (New) An apparatus as claimed in claim 63, wherein the articles are tabs to be attached to can ends and the laser engravings include markings into the metal strip to indicate a person who uses a selected one of the tabs is a winner.